

1 **USAGE BASED STRENGTH BETWEEN RELATED HELP TOPICS AND CONTEXT**
2 **BASED MAPPING THEREOF IN A HELP INFORMATION RETRIEVAL SYSTEM**

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4 **Related Application**

5 The present application is related to an application for US Letter patent, entitled "Usage Based
6 Strength Between Related Information in an Information Retrieval System" by the present inventors,
7 assigned to the assignee of the present application, having an attorney docket No. 5482, and filed
8 concurrently on even date herewith, April 14, 2000. *APR 14 2000*

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11 **Technical Field**

12 The present invention generally relates to information search and retrieval systems. More
13 particularly the present invention relates to providing related informational items during an information
14 retrieval session to enhance the performance and efficiency of an information retrieval system.

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16 **Background Art**

17 A database is useful only if a desired item can be efficiently found and retrieved therefrom. To
18 locate and retrieve a desired information item in an information database, a search of the database, e.g.,
19 based on a keyword or a text string, may be required. The search typically involves finding entries
20 matching the keyword (or string) in an index created from parsing the information items into searchable
21 words and the location in which the word appears in the database. For example, the Internet, or the
22 world wide web (WWW) may be considered as a very large database of information items, in the form
23 of web pages, distributed over a very wide network. Currently available search engines, e.g., the
24 YAHOO™, EXCITE™, and the like, maintain an index of the entire content of the WWW parsed
25 into searchable words and corresponding locations, e.g., the Uniform Resource Locators (URL).

26 However, as the size of a database becomes very large (e.g., the number of web pages in the
27 WWW is currently in the hundreds of millions, and growing fast), a user may have to navigate through,
28 i.e., select and review, a significant number of informational items before arriving at the one desired
29 informational item. The navigation through the ever increasing number of informational item to find the

1 informational items, and the one or more record entries each including an associated relationship
2 strength value based on historical frequency of selection of the respective corresponding ones of the
3 plurality of help informational items during a help information retrieval session initiated from the
4 originating locations, upon detection of a user initiation of a help information retrieval session from an
5 originating location, determining whether one or more matching record entries exist in the database for
6 the originating location, and providing, if the one or more matching record entries exist, an access to
7 one or more associated help informational items corresponding to the originating location according to
8 the one or more record entries.

9 In addition, in accordance with the principles of the present invention, an information retrieval
10 system, comprises a plurality of help informational items, and a database having one or more record
11 entries, the one or more record entries defining relationships between locations from which help
12 requests originated and corresponding ones of the plurality of help informational items, and the one or
13 more record entries each including an associated relationship strength value based on historical
14 frequency of selection of respective the corresponding ones of the plurality of help informational items
15 during a help information retrieval session initiated from the originating locations.

16 Also, in accordance with the principles of the present invention, a computer readable storage
17 medium having stored thereon computer program for implementing a method of providing a context
18 sensitive mapping of a plurality of help informational items in an information retrieval system, the
19 computer program comprises a set of instructions for providing a database having one or more record
20 entries, the one or more record entries defining relationships between originating locations from which
21 help requests are originated and corresponding ones of the plurality of help informational items, and the
22 one or more record entries each including an associated relationship strength value based on historical
23 frequency of selection of respective the corresponding ones of the plurality of help informational items
24 during a help information retrieval session initiated from the originating locations;
25 upon detection of a user initiation of a help information retrieval session from an originating location,
26 determining whether one or more matching record entries exist in the database for the originating
27 location, and providing, if the one or more matching record entries exist, an access to one or more

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1 associated help informational items corresponding to the originating location according to the one or
2 more record entries.

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4 **Description of Drawings**

5 Features and advantages of the present invention will become apparent to those skilled in the
6 art from the following description with reference to the drawings, in which:

7 FIG. 1 is an exemplary block diagram of the information retrieval system in accordance with
8 the principles of the present invention;

9 FIG. 2 is an exemplary table showing the relevant portions of the relationship database shown
10 in Fig. 1;

11 FIG. 2A is an exemplary table showing one possible example of the contents of the table shown
12 in Fig. 2;

13 FIG. 2B is an exemplary table showing a change in the contents of the table shown in Fig. 2A
14 as a result of a user action;

15 FIG. 3 shows an exemplary embodiment of the user interface screen of the information retrieval
16 system in accordance with the principles of the present invention;

17 FIG. 4A is a flow diagram showing an exemplary embodiment of the related relationship
18 database update method in accordance with the principles of the present invention;

19 FIG. 4B is a flow diagram showing an exemplary embodiment of the related information
20 provision method in accordance with the principles of the present invention;

21 FIG. 5 is an exemplary table showing the relevant portions of the relationship database shown
22 in Fig. 1, as modified to include the help relationship type for the help information retrieval system in
23 accordance with the principles of the present invention;

24 ~~FIG. 5A is an exemplary table showing another possible embodiment of the relationship~~
25 ~~database of the help information retrieval system in accordance with the principles of the present~~
26 ~~invention;~~

27 FIG. 6 shows an exemplary embodiment of the user interface screen of the help information
28 retrieval system in accordance with the principles of the present invention;

1 FIG. 7A is a flow diagram showing an exemplary embodiment of the related help information
2 database update method in accordance with the principles of the present invention; and

3 FIG. 7B is a flow diagram showing an exemplary embodiment of the related help
4 information provision method in accordance with the principles of the present invention.

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6 **Detailed Description of Preferred Embodiments**

7 For simplicity and illustrative purposes, the principles of the present invention are described by
8 referring mainly to an exemplar embodiment, particularly, with references to the Internet and the world
9 wide web (WWW) as the exemplary databases of informational items. However, one of ordinary skill
10 in the art would readily recognize that the same principles are equally applicable to, and can be
11 implemented in, other informational databases, and that any such variation would be within such
12 modifications that do not depart from the true spirit and scope of the present invention.

13 An information retrieval system in accordance with the principles of the present invention allows
14 a user to navigate through a plurality of informational items for a desired informational item, and upon
15 selection of an information item, presents other informational items related to the selected informational
16 item. The information retrieval system in accordance with the principles of the present invention
17 maintains a database that defines a relational association between a plurality of informational items in
18 the system.

19 The relational association is based on historical navigational behavior of users of the information
20 retrieval system, and includes a relationship type, which is based on the characteristic similarities
21 between the informational items, and relationship strength, which is based on the historical frequency
22 of any related informational items being selected by a user within the same information retrieval session.

23 When a navigation from one informational item to another information item is detected, the
24 relationship type and the relationship strength of the two informational items are determined and stored
25 in a database. During a subsequent selection of an informational item, any informational items related
26 to the selected informational item may be presented to the user, sorted based on the respective
27 relationship types and relationship strengths, and may be provided in a sorted list from which the user
28 can select.

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1 In an aspect of the present invention, the inventive informational retrieval system is utilized in
2 a help information retrieval system to provide a dynamic context sensitive mapping of help informational
3 items.

4 In particular, Fig. 1 shows an illustrative embodiment of the information retrieval system **100**
5 in accordance with the principles of the present invention, which may comprise, in relevant part, *inter*
6 *alia*, an information requester **101**, a navigation interface/server **106**, a search engine **102** and an
7 information server **104**. The information retrieval system **100** may be any system in which a plurality
8 of informational items are available to be searched and retrieved. For example, the entire information
9 retrieval system **100** may be housed within a single computer system, where the information server **104**
10 may comprise a database containing a plurality of informational items stored in a mass storage device,
11 e.g., a hard disk or the like, and where the information requester **101** may be a user interface through
12 which a user may initiate a search and retrieval session with the search engine **102**, which in turn may
13 be an application program running on the computer. In this example, the communication interfaces **105**
14 and **108** may be, e.g., bus(s) within the computer system.

15 Alternately, the information retrieval system **100** may even comprise a single computer
16 program, in which each of the information server **104**, information requester **101** and the search engine
17 **102** may comprise a sub-component of the single computer program. In this case, the communications
18 interfaces **105** and **108** may themselves be computer routines acting as, e.g., program interfaces.

19 In a yet another alternative embodiment, the information retrieval system **100** may comprise a
20 plurality of computers connected via a computer network. For example, the communication interfaces
21 **105** and **108** may be a wide area network (WAN), e.g., the Internet, the world wide web (WWW),
22 Public Switched Telephone Network (PSTN), or the like, through which each of the information
23 requester **101**, the navigation interface **106**, the search engine **102** and the information server **104**
24 communicate. The information requester **101** may be, e.g., a personal computer connected to the
25 Internet, e.g., via a modem or the like. The information server **104** may comprise a plurality of
26 computers, e.g., web servers, distributed over the WAN **105**, **108**, e.g., the Internet. The search
27 engine **102** may comprise any currently available and known search engines, e.g., the YAHOO™,
28 EXCITE™, and the like, and may maintain an index **103** of the entire content of the WWW parsed

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1 into searchable words and corresponding locations. An example of a known search engine and the
2 associated index may be found from, e.g., US Patent No. ^{6,021,409}~~6,021,409~~ issued February 1, 2000 to
3 Michael Burrows, the entirety of which is hereby incorporated by reference ~~herein~~.

4 Significantly, the information retrieval system **100** may further comprise a navigational interface
5 **106** having a relationship database **107**. The navigational interface **106** provides an interface between
6 the information requester **101** and the rest of the information retrieval system **100**, and may comprise
7 a server, e.g., one or more computers, allowing the information requester **101** to establish an
8 information retrieval session, and to navigate through the various informational items in the information
9 retrieval system **100**. A navigation refers herein to generally the process of sequentially selecting and
10 viewing one or more informational items.

11 Alternatively, the navigational interface **106** and/or the relationship database **107** may be
12 implemented as a part of the user interface, e.g., a web browser, of the information requester **101**, or
13 even as a part of the search engine **102**.

14 Fig. 2 shows an exemplar table illustrating the relevant portions **200** of the relationship database
15 **107**. The relationship database **107** in accordance with one aspect of the present invention comprises,
16 *inter alia*, an information item field **201** that uniquely identifies information items, **INFO#1** to
17 **INFO#N**, which may preferably be the location pointers, e.g., the URL in the case of WWW pages,
18 for the actual informational items, a related informational item field **202**, which contains one or more
19 informational items, e.g., **INFO#A** to **INFO#Z**, that are related to the informational item in the
20 informational item field **201**.

21 The relationship database **107** may further comprise a relationship type field **203**, which defines
22 the similarities between the respective characteristics of the informational items that are related, and a
23 relationship strength field **204**, which indicates the strength of the relationships between a pair of
24 informational items based on the historical frequency of the pair being selected by a user during a single
25 information retrieval session. In a preferred embodiment of the present invention, the relationship
26 strength **204** comprises a value indicator represented as an integer, e.g., 2, 4, etc.

27 According to the principles of the present invention, a related informational item record in the
28 table **200** is created when at least two informational items are selected by a user during an information

1 retrieval session. For example, during an information retrieval session, the user has navigated through
2 informational items, **INFO ITEM 1**, **INFO ITEM A** and **INFO ITEM B**, a relational record for
3 each of the pairs, **INFO ITEM 1/INFO ITEM A**, **INFO ITEM 1/INFO ITEM B** and **INFO**
4 **ITEM A/INFO ITEM B**, may be created if the respective records do not already exist in the
5 database 107. Alternately, an embodiment of the present invention may create records only for
6 information pairs which are selected consecutively, i.e., only for the pairs, **INFO ITEM 1/INFO**
7 **ITEM A** and **INFO ITEM 1/INFO ITEM B**, in the proceeding example. A yet another alternative
8 embodiment of the present invention may create records for any pair of informational items which are
9 viewed during the information retrieval session. For example, a record may be created between the
10 first and last informational items to indicate a relationship from the start of the session to the finish of the
11 session.

12 The relationship type, by way of example only, may be, in an information retrieval system
13 comprising informational items regarding a book collection of a library, a common author, a common
14 publisher and common subject, or the like, shared by the related pair of informational items.

15 According to a preferred embodiment of the present invention, a “general” relationship type is
16 provided, and whenever a pair of informational items are selected during an information retrieval
17 session, a record for the general relationship type is always created in addition to the possible record
18 with respect to the above described common trait relationship type.

19 The relationship strength may initially be assigned a value of, e.g., 1, the first time the record
20 is created, and adjusted based on the subsequent frequency of the pair being selected together in an
21 information retrieval session.

22 FIG. 2A shows an example of the contents of the table shown in Fig. 2. In this example, the
23 informational item “Rose” has a number of informational items related thereto, i.e., the informational
24 items, “Fire Truck”, “Daisy” and “Shakespeare”, which share some common traits. For example, the
25 informational item “Rose” and the related informational item “Fire Truck” are both red in color. The
26 example also shows that the relationship strength of the informational item “Rose” and the related
27 informational item “Fire Truck” sharing the same color red has a current relationship strength value of
28 4.

database 107. If any of the informational items do not already have a relationship record in the database, in step 403, a relationship type is determined for the missing pair. In an embodiment of the present invention, a record for each informational items pair with the “general” relationship type is created. In addition, a new record for each identified common trait of each pair is created. It is possible that a pair may have no common trait (e.g., the **DAISY/FIRE TRUCK** pair), in which case only the general relationship type record is created. It may also be possible that a pair may share more than one common trait (e.g., the **ROSE/DAISY** pair may share traits, “flower” and “scent”).

In step 404, for each record newly created, an initial value of the respective relationship strength is assigned, e.g., an initial value of 1. For example, if none of the pairs has an existing relationship record, then after the operations of steps 403 and 404, the resulting new records may be as shown in Table I below:

Table I

<u>Informational Item</u>	<u>Related Informational Item</u>	<u>Relationship Type</u>	<u>Relationship Strength</u>
<u>Rose</u>	<u>Fire truck</u>	<u>General</u>	<u>1</u>
Rose	Fire truck	Red	1
Rose	Daisy	General	1
Rose	Daisy	Flower	1
Rose	Daisy	Scent	1
Daisy	Rose	General	1
Daisy	Rose	Flower	1
Daisy	Rose	Scent	1
Fire Truck	Rose	General	1
Fire Truck	Rose	Red	1
Daisy	Fire Truck	General	1
Fire Truck	Daisy	General	1

If, on the other hand, in step 402, a determination is made that at least one of the informational

1 item pairs has an existing record in the database **107**, then, in step **405**, the relationship strength for the
2 existing record(s) is increased by a predetermined amount, e.g., by 1. According to an embodiment
3 of the present invention, if a record exists in the database, the related information would have been
4 displayed (e.g., as shown in Fig. 3), and the user selects therefrom. If the user had selected the related
5 informational item from a group other than the general relationship type group, the relationship strength
6 record corresponding to that selected relationship type would also be increased as well as for the
7 record corresponding to the general relationship type.

8 In step **406**, the database **107** is updated to reflect the newly created records and/or the
9 relationship strength(s) adjustment(s). In one embodiment of the present invention, the database **107**
10 is updated in real time, i.e., whenever a new record is created or a relationship strength adjustment is
11 made. In an alternative embodiment, the database may be updated off-line by collecting the
12 navigational history of users of the information retrieval system in one or more history log file. The
13 history log file may be examined periodically, i.e., daily, monthly, etc., to detect any navigation from an
14 informational item to another informational item to generate new relationship records and/or to make
15 relationship strength adjustments therefrom.

16 Fig. 4B shows an exemplary embodiment of the inventive related information provision process,
17 in which when a user selection of an informational item is detected in step **407**, the navigational interface
18 **106** performs, in step **408**, a look-up operation of the database **107** to determine whether any
19 relationship record exists for the selected informational item. If a determination is made that there is a
20 match, i.e., the selected informational item has an existing relationship record in the relationship database
21 **107**, the matching related informational items are grouped by the relationship types, sorted based on
22 the relationship strengths, and displayed as shown, e.g., in Fig. 3.

23 If, on the other hand, no relationship record exists for the selected informational item, then the
24 process ends in step **411** without displaying any related informational item.

25 As can be appreciated, the inventive relevant informational item provisioning system described
26 above, provides an efficient and economical navigational tool, by which a user of an information retrieval
27 system may find a desired informational item with less effort and time, by suggesting related
28 informational items which are historically proved useful, and by allowing the user to reap the benefits

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1 of the efforts made during a prior information retrieval session and/or by prior users.

2 In another aspect of the present invention, the relationship database **107** may include a
3 relationship type "HELP" to allow a dynamic context sensitive mapping of help informational items in
4 a help information retrieval system. In contrast to a conventional help information retrieval system,
5 which maintains a fixed mapping of the help informational items (i.e., the selection choices for help items
6 are always the same without regard to the context within which a user seeks help), the help information
7 retrieval system in accordance with the present invention provides a context sensitive mapping, in which
8 help items from which a user chooses are varied depending on the informational item being viewed by
9 the user at the time of the invocation of help. Moreover, the mapping of the help items according to the
10 present invention is dynamically updated based on the usage of the system to further enhance the
11 context sensitive nature thereof.

12 In particular, Fig. 5 shows an exemplar table illustrating the relevant portions **500** of the
13 relationship database **107** as adapted for implementation of the help information retrieval system in
14 accordance with the principles of the present invention. As shown in Fig. 5, the table **200** shown in Fig.
15 2 is modified to include relationship records **505** each having a relationship type "HELP". The help
16 relationship records **505** in accordance with one aspect of the present invention may comprise, *inter*
17 *alia*, an information item field **501** containing the location identifiers, **ITEM LOC 1** to **ITEM LOC**
18 **N**, e.g., the URL in the case of WWW pages, for the originating informational item, a related
19 informational item field **502**, which contains one or more informational item identifiers, e.g., **INFO**
20 **ITEM D** to **INFO ITEM S**, of help items that are relevant to the informational item corresponding
21 to the location identifier in the informational item field **501**.

22 Each of the help relationship records **505** may further comprise a relationship type field **203**,
23 which is always "HELP" type, and a relationship strength field **504**, which indicates the strength of the
24 relationships between the location, e.g., the **ITEM LOC 1**, and the help item, e.g., the **INFO ITEM**
25 **D**, pair based on the historical frequency of the help item being selected by a user who seeks help while
26 originating at that location. In an embodiment of the present invention, the relationship strength **504**
27 comprises a value indicator represented as an integer, e.g., 2, 4, etc.

28 According to the principles of the present invention, a help relationship record **505** in the table

1 **500** is created when a help item is selected by a user during a help information retrieval session, which
2 was initiated while viewing an informational item.

3 For example, when a user invokes help session by, e.g., clicking on the “help” button (not
4 shown), while currently viewing an informational item located at **ITEM LOC N** during an information
5 retrieval session, and selects a help item **INFO ITEM Q**, another help item **INFO ITEM R**, and
6 subsequently the help item **INFO ITEM S**, a help relationship record may be created for each of the
7 pairs, **ITEM LOC N/INFO ITEM Q**, **ITEM LOC N/INFO ITEM R** and **ITEM LOC N/INFO**
8 **ITEM S** if the records do not exist in the table **500** already.

9 The relationship strength may initially be assigned a value of, e.g., 1, the first time a record is
10 created, and adjusted based on the subsequent frequency of the help item being selected in a help
11 session initiated while viewing the informational item.

12 In operation, when a user seeks help while viewing an information item, e.g., located at **ITEM**
13 **LOC N**, the inventive help information retrieval system presents the user with a display **601** shown in
14 Fig. 6. As shown in Fig. 6, the user is provided with a selection display **601**, in which the relevant help
15 items as determined from the table shown in Fig. 5 are listed. In a preferred embodiment shown in Fig.
16 6, the help items are sorted and listed in descending order of the respective relationship strengths as
17 shown by the reference numeral **602**. Preferably, in order to provide an uncluttered and ergonomic
18 display, only a few help items having higher relationship strengths are shown along with an option to
19 view more selections by clicking on the “MORE” link **603**.

20 When user selects one of the listed help items, e.g., the help item **INFO ITEM R** by clicking
21 on the link “**ITEM R**”, the relationship strength of the help relationship record for the **ITEM LOC**
22 **N/INFO ITEM R** is increased by a predetermined amount, e.g., a one (1).

23 The inventive process of providing context sensitive help items will now be described with
24 references to FIGS. 7A and 7B.

25 As shown in Fig. 7A, in step **701**, the inventive help information retrieval system detects a
26 selection of a help item, e.g., the help item **INFO ITEM R**, by a user during a help session, which was
27 initiated when the user was viewing an informational item at a location, e.g., **ITEM LOC N**.

28 Upon the detection, in step **702**, a determination is made whether a help relationship record for

1 the **ITEM LOC N/INFO ITEM R** pair already exists in the table **500**. If the help relationship record
2 does not already exist in the table, in step **703**, a new help relationship record is created, and an initial
3 value of the relationship strength therefor is assigned, e.g., the initial value is set to a one (1).

4 If, on the other hand, in step **702**, a determination is made that the help relationship record
5 already exists in the table, then, in step **704**, the relationship strength for the existing record is increased
6 by a predetermined amount, e.g., by 1.

7 In step **705**, the table **500** is updated to reflect the newly created record and/or the relationship
8 strength adjustment. In one embodiment of the present invention, the table **500** is updated in real time,
9 i.e., whenever a new record is created or a relationship strength adjustment is made. In an alternative
10 embodiment, the database may be updated off-line by collecting the help session history of users of the
11 information retrieval system in one or more history log file. The history log file may be examined
12 periodically, i.e., daily, monthly, etc., to determine the originating informational item(s) and any help
13 item(s) selected to generate new relationship records and/or to make relationship strength adjustments
14 therefrom.

15 Fig. 7B shows an exemplary embodiment of the inventive related help information provision
16 process, in which when a user initiation of a help session is detected in step **706**, the help information
17 retrieval system of the present invention performs, in step **707**, a look-up operation of the table **500** to
18 determine whether any help relationship records exist for the location corresponding to the informational
19 item from which the help session originated. If a determination is made that one or more help
20 relationship record(s) already exist in the table **500**, the matching help items are sorted based on the
21 relationship strengths, and displayed, e.g., as shown in Fig. 6.

22 If, on the other hand, no help relationship record exists for the originating informational item
23 location in the table **500**, in step **710**, a conventional help topic contents, as is well known, is provided
24 for the user to select a help item therefrom. When the user selects a help item from the help topic
25 contents, the selection is detected as shown in step **701**, and the location/info item pair of the originating
26 informational item and the selected help item is processed through steps **702** to **705** to create and store
27 a new help relationship record in the table **500**.

28 As can be appreciated, the inventive help information retrieval system described above allows

1 a mapping of help items, which is sensitive to the context within which a user is seeking help, i.e., by
2 providing originating location specific selection choices of help items. Moreover, the mapping is
3 allowed to be dynamically updated based on the usage behavior to provide more relevant selection
4 choices and thus a more efficient use of the help information retrieval system.

5 While the invention has been described with reference to the exemplary embodiments thereof,
6 those skilled in the art will be able to make various modifications to the described embodiments of the
7 invention without departing from the true spirit and scope of the invention. The terms and descriptions
8 used herein are set forth by way of illustration only and are not meant as limitations. In particular,
9 although the method of the present invention has been described by examples, the steps of the method
10 may be performed in a different order than illustrated or simultaneously. Those skilled in the art will
11 recognize that these and other variations are possible within the spirit and scope of the invention as
12 defined in the following claims and their equivalents.